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Notes on Source and Authors

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The first article included in this translation presents the comments of two writers in response to a previously published discussion on "The Problem of the Factors of Victory in Contemporary Military Science," by Maj Gen N. A. TALENSKIY. TALENSKIY has elsewhere been identified as a Doctor of Military Sciences and former chief editor of Voyennaya Mysl'. The comments on his article were contributed by Col P. I. TRIFONENKOV and Col I. SELEZNOV. Col P. I. TRIFONENKOV has been identified in other sources as a Candidate of Philosophical Sciences.

1. ON THE QUESTION OF THE FACTORS OF VICTORY IN MODERN WARFARE

Thorough, penetrating study of the factors of victory in contemporary warfare is an important task of our military thought. Comrade TALENSKIY's article, "The Problem of the Factors of Victory in Contemporary Military Science," published in Voyennaya Mysl', No 1, 1959, provides a certain stimulus toward the resolution of this problem and promotes an active exchange of ideas.

It is known that in our military literature there is wide use of such concepts as the "regularities of the course and outcome of war," the "laws (zakony) of armed conflict," the "permanently operating and temporary factors (postoyenno deystvuyushchiye i vremennyye faktory), "military, economic, and moral potentials," etc. However, sufficiently precise scientific definitions and substantiations have not yet been provided for them. This frequently leads to futile, scholastic arguments and discussions. In this respect, Comrade TALENSKIY's article is no exception. He says that the postulation of I. V. Stalin does not reflect the natural laws of armed conflict, does not establish the nature of the methods of conducting war, does not include military art, and does not consider a number of essential factors inherent in armed conflict.

Comrade TALENSKIY proposes to name the factors "on which, under contemporary conditions, the outcome of a war depends" -- the factors of victory. Having criticized I. V. Stalin's postulation on the factors, Comrade TALENSKIY expands the system of factors of victory in war and to their number assigns the social system, the political strength of the state, its economic power, the methods of armed struggle, and strategic, operational, and tactical advantages. Here, before all else, such questions as the following arise: What are permanently operating factors? What is the substance of this concept? What are the laws reflected in it? Unfortunately, Comrade TALENSKIY completely ignores such questions; hence it is impossible to discuss whether given observations on the essence of these questions are correct or in error.

The fundamental burden of the article in question is the broadening of the concepts of the permanently operating factors and delineation of the tasks of Marxism-Leninism and of military science in the investigation of the natural laws of the course and outcome of modern wars, and its conduct.

As permanently operating factors deciding the fortune of war, I. V. Stalin singled out those most important forces to whose particular state and active operation the course and outcome of armed struggle are related directly, constantly, and integrally throughout its extent, from beginning to end. Permanently operating factors are those forces without whose presence and operation it is simply impossible to conduct a war. It is

known that armies, armaments, weapons, support of the front by the rear area, the positive attitude of the principal masses of the people toward the given war, and correct supervision of the conduct of the war in strategic, operational, and tactical respects. The direct, objective dependence of the course and outcome of a war upon the status and operation of each of these forces is constant and integral. If a dialectical type of law is applied to the analysis of this dependence, it appears that the necessary relationships between the course and outcome of war and the state of the above-mentioned forces are in the nature of objective natural laws determining victory or defeat in the war.

It is beyond question that in each particular period of armed conflict the belligerent side which surpasses its enemy in the combined force of permanently operating factors has the success. This statement is necessary, because only together do these factors determine the outcome of war, because they are interrelated and can compensate each other to a known degree. In discussing superiority in permanently operating factors as the basis of success, it must be emphasized that the greater the superiority, the more significant the success. For full victory in war decisive superiority in all elements which are the permanently operating factors of armed combat is absolutely necessary.

The concept of temporary factors is connected organically with the problem of superiority in permanently operating factors. It must be emphasized that the problem of temporary factors cannot be investigated correctly without reference to the permanently operating factors. Temporary factors are nothing more than temporary superiority over the enemy in given elements of strictly military power.

It is known that the German fascist invaders had such superiority in the first period of the war against the USSR. This superiority proved to be temporary, since it did not rest upon such important sources of military power as a social and governmental system of a progressive nature, or just aims of war. Fascism did not have, and could not have, such sources. The enemy's advantages are explained by his 2 years of experience in conducting large-scale operations in Europe and the surprise attack (vnezapnost' napadeniya) on the USSR.

It would be a mistake to underestimate the role of surprise. Surprise attack by a belligerent who surpasses his opponent in sources of military power can yield such advantages in permanently operating factors that they will not be lost in the course of war, will not be temporary, and will speed the victory. The outcome of the war in this case will be decided directly by the specific correlation of permanently operating factors which has been brought about under the great influence of the element of surprise. Thus, surprise attack influences the course and outcome of war through its effect on the permanently operating factors. In this, the force of its influence will be the greater as the strength of the permanently operating factors and their sources of the enemy, is the less.

However, it is impossible to include surprise attack in the system of permanently operating factors, as does Comrade TALENSKIY. It is only an element, although a very important one, in the method of conduct of war, of which more will be said below. Being an element in the method of struggle, surprise may be achieved, but it also may be averted. But the relation of war to the permanently operating factors cannot be avoided. It would be completely incorrect, for example, to place the victory of socialism over capitalism in a third world war -- should the imperialists unleash one -- in the same direct dependence on surprise attack as on the permanently operating factors. It is impossible to dismiss the possibility of a surprise attack by the imperialists on the USSR. However, should such an attack take place, the outcome of the war would be decided in the end by the permanently operating factors.

There are serious objections to including the social structure in the system of permanently operating factors. The role of the social system in contemporary warfare is immense, but it is manifested through its influence on all of the permanently operating factors. The social system is the most important source of the strength and stability of all of the factors of armed conflict. It qualifies the outcome of war most of all through the attitude of the popular masses toward the given war and the effectiveness of work in the rear for the needs of the front. This tremendous role of the social system cannot be simplified. It is known that the social system of fascist Germany in the last war was very much a reactionary capitalist system. But this did not hinder the fascist German invaders from enslaving almost all of capitalist Europe.

The dependence of the course and outcome of war on the permanently operating factors and on the social system is different. In the last Patriotic War the Soviet social and state system played a determining role in the speedy development and strengthening of our permanently operating factors. But this does not mean that it should be included in the system of permanently operating factors. In doing this, we confuse the category of factors and the category of their sources. The permanently operating factors determine the course and outcome of war directly, while the social and state system operates in the final analysis [i.e., indirectly] and by a more involved path. This system is one of the most important sources of all the permanently operating factors, but they do not derive from it automatically. Under one and the same system, the strength of these factors may vary greatly, depending on the attention paid them by the authorities of a country. From this follows the conclusion that the factors of struggle and their sources must not be confused or equated.

Comrade TALENSKIY's attempt to include the method of conduct of war as a factor of victory in war is not convincing. It can hardly be doubted that the method of conducting war is produced, on the one hand, by the state of weapons, military equipment, and fighting personnel, and on the other, by the subjective actions of command personnel in the organization of the armed struggle. The method of conducting war is determined by objective factors, but it is selected by people, above all by command personnel. Comrade TALENSKIY writes of this. The organizational abilities of the command personnel are revealed in war above all and most of all in the search for forms and methods of conducting combat, for forms and methods of utilizing and employing armed forces strategically, operationally, and tactically for the purpose of achieving victory over the enemy. Comrade TALENSKIY considers it an arbitrary thing to consider the method of conducting war as a direct outgrowth of the organizational abilities of command personnel. But this opinion can in no way be acknowledged as correct, for in what, then, are the organizational abilities of military leaders directly expressed in war?

The method of conducting war is nothing other than the well-developed organizational abilities of military leaders. Comrade TALENSKIY's substitution of "quality" for the concept of "organizational abilities" in no way changes its nature and is not a completely appropriate substitution of words.

Comrade TALENSKIY's thoughts on strategic, operational, and tactical advantages as an independent, permanently operating factor are merely a deciphering of his statements on the method of conduct of war. How are these advantages achieved? By better utilization of troops and application of more expedient methods and forms of conducting combat operations -- that is, by better direction of the conduct of the war. But again, all this is indissolubly connected with the organizational abilities of the military leaders, and therefore cannot be considered as an independent, permanently operating factor. If one accepts Comrade TALENSKIY's point of view, then it is possible to count very many factors and thereby completely confuse the problem of the factors determining the outcome of war and the factors influencing it, of the factors and their sources, and of the natural laws of the course and outcome of war and the natural laws of the conduct of war.

In the beginning it was said that Comrade TALENSKIY criticizes the postulation of I. V. Stalin on the permanently operating factors, because it does not reflect the natural laws of armed conflict and does not embrace military art. In actuality, this postulation on the permanently operating factors reflects the natural laws which directly determine the course and outcome of war, that is, the dependence of the outcome of war on the quantity and quality of troops, the quantity and quality of weapons and military equipment, support of the front by the rear area, the attitude of the masses to the given war, and skill in directing the conduct of the armed conflict.

The laws of the conduct of armed struggle are not reflected in this postulation, and cannot be, since this is another group of laws. It is known that the content and operation of various specific laws cannot be concretely reflected in one theoretical proposition, no matter how broad. The laws of armed conflict describe military art, which embraces a whole system of specific knowledge of the methods of conducting war. It is impossible to compress the entire theory of the conduct of war into one postulation on the permanently operating factors. Nor can it be required that the specific content and the sources of the permanently operating factors themselves be revealed in that postulation. This can only be required of military science, and not of that alone.

In connection with this, some remarks are needed on Comrade TALENSKIY's attempt to delimit strictly the tasks of the sociopolitical sciences and of military science in the investigation of the factors of victory. This attempt is connected with the broadening of the system of factors of victory in war, and their division into sociopolitical and military. To the sociopolitical factors, Comrade TALENSKIY ascribes the social system, the political power of the state, its economic strength, and the morale and political condition of popular masses (page 34). To the military factors, he assigns the quantity and quality of armed forces, arms and military equipment, morale of the troops, quality of command personnel, method of armed struggle, and strategic, operational, and tactical advantages.

On the basis of such a division the social sciences are confronted with the task of thoroughly analyzing the sociopolitical factors, and military science, that of exhaustively elaborating the military factors.

Comrade TALENSKIY's observations appear correct at first glance. However, they contain a number of inaccuracies. It has been noted above that the social, political, and state systems are the fundamental sources of military power of the state and of its victory in war. They determine, in the final analysis, the condition of all the constantly operating factors, which directly determine the course and outcome of armed conflict. Therefore, they cannot be included in this system of factors and, in this connection, the division of factors into military and sociopolitical in Comrade TALENSKIY's presentation cannot be acknowledged as successful. He inaccurately defines the immediate tasks assigned the social sciences and military science in the field of investigation of the factors of victory in war.

The fact is that a scientific investigation of the military factors can be neither comprehensive nor exhaustive without a penetrating analysis of their determinative dependence on the social, political, and state system, on the economic strength of the country, and on the political maturity of its people. Without profound dialectical-materialistic elucidation of these questions, military science cannot be a true science. Of

course, it cannot and must not occupy itself with research on general problems of the development of the economic, political, and state system. Such research belongs to Marxist-Leninist theory of social development. The tasks of military science are far more narrow.

Soviet military science studies the laws of the course and outcome of war and its conduct. It investigates the factors of victory in organic connection with their sources. It fulfills its tasks comprehensively and correctly because, above all, it proceeds from a materialistic conception of history, and is based on strictly scientific Marxist-Leninist theory. It presents in essence a dialectical-materialistic analysis of all relationships which determine the course and outcome of armed conflict and its conduct. In its content are organically combined both military and sociopolitical questions. Moreover, all basic military questions are sociopolitical questions. Even war is politics throughout. Therefore, military science is a sociopolitical science, but its content cannot include investigation of the sources of victory in contemporary warfare.
-- Col P. TRIFONENKOV

One must agree with Maj Gen TALENSKIY that the principal task of military science consists of defining the ways and means of achieving victory in armed conflict. If military science does not fulfill this task, then it is unnecessary.

But what does it mean to define the ways and means of victory? This task must not lead to merely working out formulas applicable to all events in the conduct of war. War is a highly complex and multiform phenomenon. War has many general characteristics, natural laws, and features. Moreover, each particular war resembles no other. There are no wars absolutely alike. It follows that war, more than any other social phenomenon, must be approached concretely and historically, from the position of Marxist-Leninist dialectical method.

Comrade TALENSKIY expands the question of the factors of victory too widely, far exceeding the bound of the specific nature of war. He includes among the factors such social phenomena as do not reflect the specific character of war as an armed conflict of sides and do not flow from it (the social system, political power of the state, economic strength, morale and political condition of the popular masses, science, etc.).

Our opinion is that the problem of the factors determining the course and outcome of war cannot be resolved in this way.

Military science, as Comrade TALENSKIY correctly points out, has as its object the investigation of the specifics of war -- armed struggle in its indissoluble connection with other phenomena and processes of war. However, the conclusions of his reasoning depart from this correct thesis.

It is the continuation of politics by other means. Marxist science shows the close connection of war as a social phenomenon with other phenomena in the life of a society. But war is radically different from other all social phenomena. The difference is that war is not ordinary, but forced, politics. War accomplishes political tasks by forcible coercion. To compel an enemy to lay down his arms, it is first necessary to destroy his army. But this is not all. If we destroy the enemy's troops, but in the same step render our own armed forces lifeless, then we shall hardly be able to impose our will on the enemy.

The chief aim in any armed struggle is to destroy the enemy while preserving one's own forces.

The specifics of war as an armed struggle lie in the above-stated aim. For the military man this is the chief, most important thing, since all problems of strategy, operational art, and tactics flow precisely from the specifics of war.

> "Preservation of our forces and the destruction of the enemy's forces, as the aim of war, is the very essence of war and serves as the basis for all combat operations. This fundamental nature of war permeates it through and through, beginning with purely technical methods and ending with strategy. The stated aim of war -- preservation of our forces and the destruction of the enemy's forces -- is the basic principle of war, and all precepts and principles of combat training, tactics, operational art, and strategy are completely inseparable from it." (Mao Tse-tung, Selected Works, Volume 2, pp 270-271; Foreign Literature Publishing House [Moscow], 1953)

From this follows an important conclusion for describing the factors which exert a decisive influence on the course and outcome of war: it is necessary to take as a basis that which derives directly from the specifics of war.

To search for laws in the specifics of a phenomenon studied is an elementary requirement for any science.

The most widespread error in searching for new "factors of victory" is the equation of the conditions of the conduct of war with the factors of victory and defeat. The conditions of the conduct of war and the factors of victory are not one and the same.

The conditions of the conduct of war constitute the objectively existing environment (political, economic, military, geographic, international, etc.) in which war unfolds. The conditions in which combat operations proceed represent the sociopolitical and natural background on which the armed struggle between antagonists takes place. It goes without saying that favorable or unfavorable conditions for the conduct of war contain in themselves the possibility of a particular outcome of the war. However, the conditions taken by themselves offer neither victory nor defeat. The possibility which they hold for a particular outcome to the war must be transformed into reality by active, conscious efforts of people, mobilizing all capabilities for securing the victory.

Consequently, the factors of victory in war have relation to the conscious activity of people in mobilizing economic, moral, and military efforts for the needs of war, the rational utilization of which ensures the achievement of victory in armed conflict.

In Comrade TALENSKIY's article, first among the factors conditioning the achievement of victory in war stands the social and state system, as well as the "political power of the state" and its economic strength and the morale and political condition of the popular masses. Can these be called factors of victory in war? In our opinion, no. If these are "factors" of victory in war, then they are in the same degree factors of victory in the struggle for industrialization of the country and the collectivization of agriculture in the struggle for the building of socialism and Communism, for alteration of the social consciousness of the masses, for peaceful economic competition between capitalism and socialism, etc. But in that case, these are universal factors, and not specific factors of military victory. The task of military science is to seek out and disclose the fundamental factors which, under given socioeconomic, political, and cultural conditions, ensure decisive superiority in an armed struggle with a powerful enemy.

Comrade TALENSKIY reproaches I. V. Stalin because, in enumerating the permanently operating factors, he did not cite those which are directly related to military art. Can we lay such demands on the factors of war? It is believed that, for two reasons, we cannot. First, however ideally formulated the factors may be, they can never entirely embrace the whole complexity of the phenomena of armed conflict. Second, in ascertaining the factors determining the course and outcome of war, the question is not how to win the battle, operation, or action, but how to win the war as a whole; or, as Comrade TALENSKIY says in the beginning of his article, the question involves the factors "on which the fate of war, in contemporary conditions, depends." Consequently, it is a specific feature of the factors of victory that they embrace the whole war, and not separate episodes of it. The problem of military factors and of the mobilization of them for the achievement of victory in war relates above all to political and military strategy.

The successful execution of operations and battles is based directly on the skill of commanders in the rational employment of weapons and personnel in the concrete conditions of combat actions. This art is regulated by the military regulations and instructions, and by the principles of operational art and tactics. Therefore, there is no need to invent any such special factors for the winning of operations and battles.

Comrade TALENSKIY believes that I. V. Stalin, in setting down the postulation on the permanently operating factors, considered surprise only as " a moment in military affairs which is attendant, i. e., which is gained by chance (?), from without."

This contradicts the historical truth. As is obvious from Stalin's statement, he not only recognized the role of such a temporary (meaning also, attendant) moment as surprise, but also showed that, relying on it, the Germans had great successes in the first phase of the war. Stalin definitely considered surprise a military advantage for the Germans -- a reserve force of the fascist German troops. He said:

> "Now the outcome of the war will be decided not by such an attendant moment as the moment of surprise, but by permanently operating factors: the solidity of the rear, the morale of the army, the quantity and quality of divisions, the weapons of the army, and the organizational skills of the army's command personnel." (I. Stalin, O Velikoy Otechestvennoy voyne Sovetskogo Soyuza (On the Great Patriotic War of the Soviet Union), Gospolitizdat /Moscow/, 1950, pages 43-44)

According to this formulation, the outcome of the introductory phase of a war can be decided by the moment of surprise.

Comrade TALENSKIY has expressed doubt as to the expediency of the division of the factors into the permanently operating and the temporary. He considers them under one heading: the factors of victory. It is impossible to agree with this for the following reasons.

The natural law of preparation and conduct of war is to break the will of the enemy to resist and to accomplish victory in the shortest period of time and with the smallest loss of forces. The ideal method of conducting war would be the achievement of victory with one blow. In the history of wars we find many examples of the application of suitable methods and approaches leading to the achievement of this ideal: concealed preparation for war, early mobilization of armed forces, surprise, unexpected opening of military activities, novel means of combat and methods of employment of them, etc. All of this has the effect of stunning an enemy who is unprepared for war.

It is especially important to study this sort of situation in our time, when the destructive power of contemporary means of combat has increased many times over. Thorough investigation of the permanently operating factors, together with thorough, comprehensive investigation of the conditions which influence the course and outcome of war as temporary factors, is the task of contemporary military theory. The erroneous view that temporary factors cannot decide the outcome of the war was widely publicized in the Soviet military press. Investigation of war has shown that the temporary factors (especially surprise) can, under certain conditions, decide the war in favor of that side which exploits them. From this correct principle an erroneous conclusion was drawn: that, if it is possible to gain victory in war with the aid of surprise, then surprise is transformed from a temporary into a permanently operating factor.

The temporary factors are called temporary not because the outcome of a war cannot be decided with their help, but solely because they operate with greatest force only in a particular period of the war, and not over its entire duration. But the role of the permanently operating factors, i. e., those which operate through the whole course of the war, from beginning to end, is continually increased in the process of war.

In evaluating the known permanently operating factors we must first pose the question: what is to be the basis for grouping factors under the rubric of permanently operating? This can be answered thus: the basis for consideration of all the factors is not the general sociological, but the military aspect, which wholly derives from the specifics of war. Comrade TALENSKIY writes that the morale of the army, the quantity and quality of divisions, the army's weapons, and the organizational skills of the command personnel belong to the "strictly military factors." But for reasons completely beyond comprehension he does not include the strength of the rear as a military factor.

It is impossible to agree with this. In concept the rear is opposite to the front. While there is no war, there is neither rear nor front. In time of war the front cannot exist without the rear. The rear in our country is the unity of the people with the army, their selfless labor in industry and agriculture, their active support of the military effort of their government, their organization and discipline. The rear may be considered strong if all classes of the given society subordinate their activities to the interests of the front and the interests of achieving victory over the enemy. From this it is obvious that the rear is in concept a military factor which cannot under any circumstances be replaced by such concepts as the social or state system, politics, science, etc. These are conditions determining the degree of solidity of the rear of the particular state. A strong rear is the consequence of a more perfect social and state system, correct policy, a high level of culture and science, etc. It does not follow that it is necessary to equate the cause and effect.

Hence, when we speak of the factors determining victory in war, it is of factors of a military order. They are directly connected with war, and it is necessary to explain them, proceeding on the basis of the specifics of war.

The factors determining the course and outcome of war bear a historical character. They change and develop with the changing conditions of the conduct of war.

The first step on the way to resolution of the problem must be precise, clear ascertainment and delimitation of concepts so that our ideas of the subject of investigation will be definite and consistent. In making the first step, let us clearly establish what is relevant to the subject of investigation and what is not. We shall thereby narrow the circle of problems and stop trying to embrace the boundless.

The second step is scientific analysis of the Stalinist temporary and permarently operating factors, with the aim of explaining which of these continues to operate in our age and which have become obsolete.

The third step must be a thorough analysis of the fundamental tendencies of the development of contemporary military science in order to disclose new factors determining the course and outcome of war. In our opinion, a tendency clearly emerging in military affairs is the growing significance of scientific and technical progress. In the elucidation of the factors of war, research must be conducted in this direction.

Comrade TALENSKIY refers to the factor of "quantity and quality of armed forces"; he cites "weapons and military equipment" instead of "weapons of the army" and "morale and fighting spirit of the troops" instead of the "morale of the army"; instead of the more apt term "organizational capabilities of command personnel," he proposes "quality of command personnel." This can hardly alter the essence of the matter. If something new is contained, it is of such infinitely small magnitude that it can be ignored, so as not to confuse the true problems.

The new factor, "method of armed struggle," proposed by Comrade TALENSKIY calls forth an objection. In the first place, method of armed struggle is too indefinite a concept, one which unfortunately has not until now been discovered in military science.

In the second place, method of conduct of armed struggle embraces various levels of war, from tactics to strategy. These are the subject of research under military art. But the factors of war determine the course and outcome of the war as a whole.

It is sometimes considered that science, space, and time must be new factors of war under contemporary conditions. Certainly what science provides for armed conflict has great, even paramount, importance for success in modern warfare. This question requires fundamental consideration and research. As for space and time, it is incorrect to consider these as specific factors of war. Space and time are objective forms of existence of matter. All objects and phenomena exist and develop in time and space. Wars of all ages have likewise occurred in space and time. Space and time are not specific conditions exclusively of modern war. Moreover, space and time do not themselves produce victory or defeat. The fact that modern wars will take place in many theaters of military operations and will cover great space does not provide a basis for considering space and time among the factors of war. -- Col I. SELEZNEV

II. COUNTERATTACK AND REPULSE OF COUNTERATTACKS

The delivery of counterattacks, in the course of defensive operations, against a formation of the attacking forces which has achieved a break-in, and the repulse of counterattacks, in the course of offensive operations, by the attacking side, are acquiring increasing importance under present-day conditions. Highly motorized and mechanized troops and the availability of means of mass destruction, particularly atomic weapons, provide all prerequisites for accomplishing, in the course of defensive operations, active counteroperations against the attacking force, primarily by inflicting counterattacks.

From experience in past wars it is known that very often strong, aggressive counterattacks have resulted in the destruction of separate formations of the attacking forces and sometimes in the withdrawal of these forces to their initial position, which in essence meant that the offensive operation failed.

Unquestionably, with the increasing role of second-echelon elements and reserves which are capable of quick maneuver, and with the constant quantitative and qualitative increase of weapons of mass destruction, the capabilities of the defending forces for achieving counterattacks are considerably enlarging and the role of counterattacks in operations is sharply rising. With the employment of weapons of mass destruction, counterattacks may be conducted with a more decisive objective, which is the defeat of an advance begun by the enemy or the destruction of his attack group (udarnaya gruppirovka) in a relatively short period of time and the recovery of lost defensive positions. Consequently, a counterattack may serve to reduce the tempo of the advance, exert a highly unfavorable influence on the development of the offensive operation, and bring about a turning point in the course of the defensive battle, advantageous to the defending forces.

It follows that action against the reserves of the defending forces and the repulse of their counterattacks, in the course of offensive operations, is one of the most important problems for the advance. The availability of weapons of mass destruction and the high mobility of present-day troops considerably increase the capabilities of the attacking forces for conducting more effective action against various types of reserves and successfully repelling their counterattacks.

It is known that under contemporary conditions, because of the frequent and drastic changes in the situation, an offensive operation will develop unevenly. On one line of advance the troops may successfully attack and even pursue retreating formations, while on another they will be forced to advance slowly and repell counterattacks by the defense. Rapid change in the situation in the course of operations requires that the troops be in constant readiness to repel and execute counterattacks.

In modern operations, success will be on the side which is able to form attack groups quickly and forestall the opposing side in the employment of weapons of mass destruction, in the execution of maneuver by forces and means in attack groups, and in the delivery of unexpected, powerful, vehement attacks and counterattacks.

The modern defense has real capabilities for waging active combat to achieve objectives which are more decisive than heretofore to the defensive operation. Activeness in the defending forces is exhibited above all in the systematic inflicting of blows by atomic and rocket weapons, aviation, artillery, and other means against the attack groups of the offense, including its second-echelon forces and reserves, and particularly against its means of mass destruction. The clearest demonstration of high activeness in the modern defense in the course of an attack begun by the enemy is the counterattack. The delivery of counterattacks in the course of a defensive operation at the most critical moment for the attacking side can sharply alter the general situation and the correlation of forces, in favor of the defense, thereby depriving the attacking forces of the initiative on the given lines of advance.

Counterattacks are undertaken by the defense principally to halt the attacking forces, to prevent their further advance in depth and on the flanks, to recover a previous defensive position or stabilize the defense on lines occupied at the moment when the counterattack is launched, and thus to gain time until the arrival of reserves from other directions and prepare an advantageous attack position for a possible subsequent shift to a counteroffensive. Counterattacks may also be executed with the objective of preventing the isolation or encirclement of the friendly forces; to rout separate groups of the attacking forces which have moved forward the furthest; to relieve friendly troops which are encircled and bring them out from the encirclement; to destroy operational bridgeheads on streams and beachheads on coasts, etc. Under modern conditions, with the availability of atomic weapons, counterattacks may pursue even more decisive objectives -- stripping the enemy of the offensive and seizing the initiative from his hands.

In modern defensive operations the skillful formation of groups, their quick and concealed concentration, and their timely deployment to execute unexpected, decisive counterattacks are highly important measures. Groups for executing counterattacks are formed in accordance with the defensive operational concept, at the beginning or in the course of the operation, so as to secure on the directions of counterattack superiority over the offense in forces and means, particularly aviation, armored troops, and weapons of mass destruction, which makes it possible to develop the counterattack at high tempo. The composition of these groups in each case will be determined by the objectives and missions of the defense, by the importance of the operational or strategic line of advance on which events are developing, by the character of the theater of military operations, by conditions in the situation, and, above all, by the availability of uncommitted forces and means in the defense and the quantity of weapons of mass destruction allocated to the defensive operation as a whole and to the support of counterattacks in particular.

The basic elements of groups designed to execute counterattacks will usually be armored troops, supported by aviation and rocket weapons and supplied with a considerable quantity of atomic weapons and other means of mass destruction. The defending side, obviously, will in every case endeavor to bring up a greater quantity of forces and means for destruction of the enemy. However, in the course of defensive operations it is clearly not advantageous to form unwieldy groups. Modern weapons of destruction and the level of technical equipment of troops make it possible to resolve this problem through qualitative change in the composition of groups intended for executing a counterattack. They may be comparatively small, but powerful and capable of accomplishing their assigned missions in a short period of time.

Counterattacks are executed most frequently by second-echelon forces of operational ob'yedineniye, as well as by operational and strategic reserves, which are concentrated beforehand in the depth of the defense or shifted during the operation from other lines of advance and from the deep rear. The possibilities of moving these reserves to the battlefield have now significantly increased and, moreover, transport by air of whole chasti and sometimes even soyedineniya presents no particular difficulties and may be widely employed in modern defensive operations. Some first-echelon forces of ob"yedineniya may also take part in the counterattack, in coordination with the second-echelon forces and reserves. An important advantage in a counterattack executed by second-echelon forces and reserves alone, or jointly with part of the first-echelon forces of ob"yedineniye, is the great force of the attack. In cases when the defending forces have an adequate quantity of atomic and rocket weapons, aviation, and other means of combat, it is not impossible that a counterattack may be executed by forces in the first echelon of the ob"yedineniye, for which it is advantageous to reinforce it with separate chasti or

soyedineniya. On the positive side [illegible] surprise will be easier in a counterattack executed by the first echelon of an ob"yedineniye, in comparison with a counterattack by second-echelon forces and reserves.

To all appearances, it is most advantageous to form attack groups from forces making up the second echelon, reserves, and first echelon of ob"yedineniye. The methods used to form these groups depends on the situation and, above all, on the availability of forces and means to the defense and the possibilities for achieving the necessary superiority over the enemy on the given line of advance. However, it is possible that second-echelon forces and reserves may be partly, and sometimes even completely, employed to reinforce the combat formations of the first echelon or to hold a defense zone (polosa oborony) in tactical or operational depth. In this case, groups for executing counterattacks are formed from sectors of the front which are not under attack and from secondary lines of advance.

The concentration and deployment of attack groups may be organized and accomplished in various ways. Usually the concentration and deployment of these groups will take place during a defensive battle when the defensive front is broken and the troops are operating against superior attacking forces. The attacking side, using various combat means, will endeavor to deliver blows against such groups, so as to break or at least weaken their attack. Thus the importance of preserving their striking power is clear. This can be achieved, above all, by the rapid advance and concealed concentration and deployment of troops, and by protecting them securely against enemy ground and air action.

Of course, groups which are to execute a counterattack should not be concentrated in random areas which have not been organized with respect to engineer fortifications nor, especially, deployed on unprepared lines. Sometimes, however, it will be necessary to disregard these provisions in order to gain time.

An important condition for rapid, concealed concentration of troops for execution of a counterattack is the determination of the order of their concentration and deployment. The decision of this question must be sought, first of all, in the qualitative change in the composition of groups, and dispersion of them along the front for deployment on several sectors.

Under modern conditions, with the qualitative change in the composition of groups and the possibilities for forming them in short intervals of time, counterattacks in defensive operations may be executed more frequently then during the last war. In the course of a defensive operation, not one, but several simultaneous or successive counterattacks may be undertaken. For example, the defending forces may deliver one counterattack in tactical or close operational depth using forces from the closest operational reserves, and simultaneouly or subsequently another

forces from operational reserves disposed in depth. In the operational depth of the defense, counterattacks may be executed by operational or strategic reserves, either simultaneously on several directions of advance, or successively on one direction.

The number of counterattacks in each particular operation conducted by ob"yedineniye depends on the concept of the operation and the nature of its conduct.

If the counterattack is to be delivered on one direction, of advance, then, naturally, it is necessary to form one powerful group which may, in our opinion, execute the counterattack from several different sectors. When several counterattacks are to be delivered simultaneously, under modern conditions, most typically an attack group is formed for each direction of advance, with the strongest on the main direction. Depending on the concept of the operation, the counterattacks may be executed simultaneously or at different times.

The timing of counterattacks depends on the missions which the defense must accomplish and on conditions which concretely affect the situation. Obviously, the most favorable moment for a counterattack is considered to be when the attack groups of ground troops on the attacking side have expended their important reserves, and when the defending side, on the directions of advance of the counterattacks, has succeeded in seizing the initiative in the air and achieved superiority in forces and means, primarily in weapons of mass destruction. With the availability to the defending forces of a sufficient quantity of weapons of mass destruction, it may also be advantageous to execute a counterattack when the attacking side still has a capability for offensive action.

Should the attacking forces have superiority in aviation and weapons of mass destruction, a counterattack may be executed at night. Of course, this is highly complex, but the defending side thereby gains a substantial advantage. A counterattack such as this considerably impedes the effective use of aviation and the employment of atomic weapons by the attacking forces, and enables the defending forces to achieve surprise.

The forms of maneuver in the conduct of counterattacks may vary. The most widely applied form must be considered the assault against one or both flanks of the group of attacking forces which has broken into the defense. The defending forces may also deliver frontal assaults, which in many cases will be combined with flank attacks. Frontal assaults may be employed not only to halt or retard the advance of enemy attack groups, but also, given a sufficient number of atomic weapons, to disperse them and then destroy them piecemeal.

In an offensive operation the counterattacks conducted with the aim of frustrating and repelling counterattacks of the defense must be considered in relation to the basic tasks and ultimate goal of the operation of the given operational ob"yedineniye, for the repulse of counterattacks of the defense is a special, intermediate task on the way to fulfillment of the immediate or ultimate mission of the ob"yedineniye.

The frustration and repulse of counterattacks of the defending side is of great importance in ensuring the high tempo of operations and in carrying them to great depth. Through timely frustration of counter-attacks, favorable conditions are created for a rapid shift of effort by the attacking forces from tactical to operational depth, for piecemeal destruction of the defending troops and achievement of the ultimate objective of the operation.

Frustration of counterattacks is essentially the inflicting of defeat on the operational and strategic reserves of the defending forces which may, throughout an offensive operation by an ob"yedineniye, be brought in for counterattacks. Therefore, as shown by experience in the last war, the effort against the defensive reserves can be most successful only if it is begun well in advance of the start of the offensive and continues uninterruptedly throughout its course. It follows also that action by the attacking forces to frustrate possible counterattacks must be initiated at the moment when a concentration of defensive reserves, and particularly their preparation for counterattacks, is discovered. An important role in the frustration of counterattacks is played, beyond question, by well-organized reconnaissance conducted uninterruptedly with the aim of determining the disposition of the defensive reserves and their preparations for counterattacks.

The frustration of counterattacks of the defending forces during offensive operations may be accomplished by various methods; for example, through systematic strikes by aviation, rocket weapons, and long-range artillery delivering means of mass destruction against rail and road junctions and against groups of ground troops in their concentration areas and during regrouping and shifting, as well as by incessant efforts to weaken the aviation groups of the defense and to deliver strikes against airfields at which transport aviation for airborne forces is based.

Such action obviously reaches its greatest intensity during the deployment of groups to launch counterattacks. At this time the composition of the groups, their lines of deployment, and directions of counterattack may be most precisely determined. Troops on the line of deployment will usually be in relatively compact groups. Consequently, it is possible at this time to utilize all means of combat, including artillery, most purposefully and in the greatest mass, and to inflict on the defense losses which may force it to abandon the execution of counterattacks.

A [illegible] effective measure for frustrating counterattacks is the surprise, massed employment of atomic and other weapons of mass destruction against principal groups and, above all, against defense reserves during their concentration and deployment for counterattacks, as well as the immediate destruction of weapons of mass destruction which have been detected.

Important conditions which permit the disruption of preparations for counterattacks are a fast tempo and a resolute quality in the actions of the attacking troops, by which the attacking forces forestall the defenders' employment of atomic weapons and capture of advantageous positions, and thus prevent their deployment of forces and means for launching counterattacks.

Airborne landings in the defensive rear with the aim of disrupting the control of troops and, primarily, halting the forward movement of reserves and then destroying them with the assistance of troops arriving from the front, can be of great importance in the frustration of counterattacks of the defense.

Thus, in the effort against defensive reserves, to frustrate counterattacks readied by them, all arms and all branches of the armed forces participate, utilizing weapons of mass destruction on a broad scale.

Under modern conditions the defense, despite all efforts to frustrate it, may still deliver a counterattack. The attacking forces must, within a short time, repel it by a counterblow (vstrechnyy udar) or in place (s mesta) by shifting temporarily to the defensive on the given sector. Irrespective of the method of repulse, the group of defensive forces which executes the counterattack must be completely destroyed.

In modern offensive operations a very widely utilized method for repelling counterattacks will involve counterblows and the destruction in meeting engagements of groups of defending forces moved out to deliver counterattacks. It is expedient to execute counterblows for this purpose when conditions of the general operational situation are favorable and the correlation of forces and means on the lines of advance of the defensive reserves is advantageous. It should be kept in mind that the employment of weapons of mass destruction against advancing groups of the defense makes it possible, with skillful organization and execution of meeting engagements, to destroy these troops with equal and sometimes even smaller forces available to the attacking side on the line of advance. The striking of important, well-reconnoitered targets by atomic weapons in coordination with other means makes it possible to inflict substantial personnel and equipment losses on attack groups of the defense, while subsequent blows, particularly on the flanks of these groups, create optimum conditions for their quick destruction.

Another method of repelling counterattacks in the course of offensive operations which may be cited is the temporary shifting of part of the attacking forces to the defensive on the lines of movement on which the counterattacks are delivered, with a simultaneous or subsequent strike by another part on the flank of the attack groups to achieve their final destruction and establish conditions favorable to the conduct of the offensive operation as a whole.

Let us consider some situation factors, and some features peculiar to the repulse by attacking forces of defensive counterattacks, which appear to us as most typical of modern offensive operations.

Anticipation of the development of an offensive operation permits a general determination of the areas of concentration of the defensive reserves and the directions of counterattack; and timely planning of a number of measures designed to successfully repel them However, as shown by experience in the last war, the specific situation in which the repulse of counterattacks may be required may not always be foreseen with adequate certainty.

Under modern conditions the defensive side, possessing a high degree of troop mobility, may concentrate in a short time sufficiently strong, primarily armored, groups to organize an opposition to the offense. In this case the attacking side must also create strong groups, capable not only of repelling a counterattack, but of defeating the enemy. Sometimes this will involve large-scale regroupings embracing considerable forces and means, and will require the expenditure of a certain amount of time.

Of course, for the most successful repulse of the defense's counterattacks, it is advisable to have uncommitted forces -- second-echelon and reserve -- which in the course of the advance shift to the most probable directions of counterattack. These second-echelon and reserve forces must be positioned in dispersed fashion, yet in full readiness for action and at such distance from the first echelon that they may quickly move out and secretly deploy on the threatened directions of movement. As to first-echelon troops in action on the directions of counterattacks launched by the defense, these troops most often will repel attacks by temporarily shifting to the defensive in order to wear down and exhaust the groups delivering the counterattacks, then, together with second-echelon and reserve forces, destroying them. In all circumstances it is necessary to designate in advance the forces and means for repelling counterattacks, to assign tasks to the troops and ensure their accomplishment.

A transition to the defensive on the directions of counterattack in the course of offensive operations may be forced or premeditated, but an attempt must always be made to seize advantageous positions or to utilize terrain which has been organized by the opposing side. A forced shift by the attacking forces to the defensive, and its organization, is usually carried out in a complex situation, in an extremely limited period of time, very often when superiority is with the counterattacking forces, particularly in armored groups, and with intensive action by air, rocket weapons, and means of mass destruction on the part of the defensive side. A premeditated shift by attacking troops temporarily to the defensive with the aim of repelling counterattacks will occur under more favorable circumstances. Troops of the operational ob"yedineniye may occupy in advance the most favorable positions, will have more time for organization of the defense and, consequently, may hold the occupied positions more reliably and assign more available forces to active repulse of the counterattack. In any circumstances, in a temporary shift to the defensive, all measures must be taken to strengthen the stability of the defense and establish conditions favorable to the repulse of counterattacks.

It is also necessary to select the most advantageous moment to deliver the attack. The attack should not be delayed until the counterattacking troops have been halting everywhere or until the defense has brought all of its reserves into the battle.

The most important factors dictating the moment for launching the attacks, and consequently for shifting again to the offensive on the directions of counterattacks, are above all the capability for effective, surprise employment of weapons of mass destruction against the troops delivering the counterattack, and readiness of the concentrated attack groups of the offense.

If the defense launches a counterattack with considerable superiority of forces and means over the attackers, and if the commitment of troops for resolute destruction of the group created by the defense for the counterattack may result in the weakening of the main forces of the ob"yedineniye operating on other, decisive lines of advance, then it is expedient to effect the repulse of counterattacks by a timely shift to the defensive on a favorable line. This makes it possible to neutralize and pin down the group delivering the counterattack for a certain period of time. Under the given conditions it is more advantageous to effect the defeat of this group of defensive forces only after the troops of the operational ob"yedineniye have accomplished the principal or important intermediate missions on the direction of main effort.

temporary shift of part of the forces to the defensive on the direction of the counterattack must not halt the advance of troops of the operational ob"yedineniye on other directions. And only when the defense's counterattack develops into a counteroffensive, and an unfavorable correlation of forces is created and the general operational situation deteriorates significantly, may the attacking troops of the operational ob"yedineniye shift to the defensive in all zones to repel the counterattack. This may occur most often when the troops of the operational ob"yedineniye are in the process of executing their ultimate missions in the operation. Having repelled a counterattack in place, the troops of the operational ob"yedineniye may in this case consolidate on the lines which are gained and proceed to prepare a new offensive operation.

In modern operations, not one, but two or more counterattacks on several directions may be launched simultaneously by the defensive side on the sectors of attacking ob"yedineniya. Under such conditions the attackers must above all determine which is the principal and most dangerous of the defense's groups at the given moment and direct the principal effort against it. On other directions of counterattack it is necessary for part of the forces to take cover temporarily and operate primarily with the aim of stopping the advance of the groups delivering the counterattacks. Later it is necessary to shift the effort, to annihilate all remaining groups which are executing counterattacks.

If the operational ob"yedineniye on the attacking side has sufficient forces and means and, above all, weapons of mass destruction, the simultaneous destruction of groups of the defense which are delivering counterattacks from various directions may be accomplished.

Troops advancing in directions where counterattacks have not been launched by the defense may detach part of their forces and means to reinforce groups which are repelling counterattacks. On the other hand, they may render important assistance by a swift attack in depth and seizure of operationally important areas, with the capture of which the entire system of defense collapses and the counterattacks themselves lose their operational significance. Examples of such actions are found in many operations of the Great Patriotic War (the L'vov-Sandomir, Budapest, Visla-Oder, and others).

In modern offensive operations, by a number of shattering blows by powerful groups supported by aviation, rocket weapons, and artillery and provided with sufficient weapons of mass destruction, it is possible to achieve a quick shift of effort to operational depth and a deep penetration into the defense, and thus create much more quickly than in the past a situation in which counterattacks by the defenders lose their operational significance. In this case the troops of the defending side intended for counterattacks will obviously be utilized most often to

fill in the numerous gaps in the system of defense. At the same time, troops attacking in other directions and not subjected to counterattacks must act in accordance with the general conditions of the situation in the zone (polosa) of the given ob"yedineniye and in neighboring units, and be in full readiness for any unexpected circumstance -- for repelling counterattacks or rendering assistance to groups already engaged in repelling counterattacks of the defenders.

The control of troops must be so arranged as to provide reliable, uninterrupted direction of the actions of the troops in frustrating, and particularly in repelling, counterattacks and in destroying the groups which deliver the counterattacks. The basic concept for repulse of possible counterattacks in the course of an offensive operation is expressed in the general decision for the operation. Herein the most likely directions of counterattacks in the course of the operation must be indicated, the forces and means for their repulse must be noted in accordance with the missions of the operation, and the tasks of troops in frustrating and repelling counterattacks must be established.

In the course of the offensive operation the tasks of troops in repelling counterattacks must be specified in accordance with the developing situation, and with sharp changes in the situation, must be re-established. Under modern conditions, when the situation may change rapidly and drastically, it is impossible to linger, and more so to be late, in reaching a decision on the repulse of counterattacks. The decision which is made must be conveyed to the troops in the shortest time. The main problem is the timely execution of various types of measures with the aim of creating conditions for frustrating and successfully repelling counterattacks.

On the basis of the decision and the situation as it actually develops, the offensive side, upon detecting the readying of counter-attacks by the defense, attempts above all to effect measures to frustrate the counterattacks. Simultaneously, measures are taken to achieve a stable disposition of troops on the threatened sectors. For this purpose, on the directions of probable counterattack by the defenders, reserves of various types, and sometimes second-echelon forces of the soydeineniya and ob"yedineniye, are brought up in advance. On these directions the troops occupy gaps, adopting combat formations in the course of the attack. Special attention is given to securing the flanks and consolidating captured ground. Measures are taken for the all-round security of the troops designated for repulse of the counterattacks.

Coordinated action plays an extremely important part. It must therefore be organized among the arms and armed forces branches and among the echelons in the operational formation of troops on a timely basis and, in general outline, even prior to the start of the offensive operation. In the course of the operation, after the decision has been taken on the repulse of counterattacks, the organization of coordinated action must be of a more concrete character. The tasks of the troops on the anticipated directions of counterattack by the defense are specified or revised, and matters of coordination among the various elements of the operational formation, the arms and armed forces branches, as well as neighboring units, are correlated. In the course of the repulse of counterattacks, particular matters of coordination may be further detailed or revised.

Thus, in modern operations there is a whole series of problems pertaining to the execution of counterattacks by the defense and their repulse by the offense, which are closely interwoven.

The availability of weapons of mass destruction and their skillful employment, and the increasing capabilities of troops to accomplish maneuver, make it possible effectively and in a shorter time than in the past to execute tasks in the frustration and repulse of counter-attacks of the defenders -- which creates conditions favorable to the destruction of the groups which deliver the counterattacks, and to the swift development of the offensive operation until its final completion -- as well as tasks connected with the destruction of the offensive attack group through the delivery of counterattacks and subsequent restoration of a stable situation for the defense. -- Maj Gen B. GOLOVCHINER

New synthetic materials known under the general name of polymeric materials have been added in our time to the long-known metals, minerals, and organic materials from which armaments and combat equipment have been produced. Polymeric materials have many remarkable qualities.

Several examples will indicate the characteristics of these synthetic materials. Plastic bearings, as distinguished from bronze, do not require lubrication, resist friction, and last five to ten times longer than metal ones. Plastic glass springs are not inferior in length of service to steel ones. Of the different types of gears which are produced from polymeric materials, in many cases they are not inferior to steel ones in technical and service qualities, but even surpass them. Many types of polymeric materials are resistant to acids and alkalies, which makes machine parts produced from these materials especially valuable. Plastics reinforced with fiber glass are not inferior in strength to nonferrous metals and, after additional heat treatment, to the best grades of steel. Steel products are 4-4.5 times as heavy and duralumin products are 1.5 times as heavy as fiber glass. Hulls for river cutters and small diesel-powered ships, various machine tools, machines, automobile chassis, etc. are already being produced from laminated plastic glass.

Superlight plastics are an extremely interesting variety of plastics. They are obtained as a result of foaming -- that is, filling a large volume of plastic with air, nitrogen, and other gases. Hence, these are also called "foam plastics" and "honeycomb plastics."

These polymeric materials can be elastic as rubber, hard as metal, or brittle as glass. They may soften at a temperature of plus 60 degrees or resist heating up to 200-300 degrees centigrade or above. Some of them burn excellently and others are not inflammable at all. Many foam plastics are resistant to acids, alkalies, and other aggressive agents. Foam and honeycomb plastics are easily worked with ordinary woodworking tools. But the primary property of foam and honeycomb plastics is their unusually low specific weight: the weight of one cubic meter of various foam plastics does not exceed 10-15 kilograms. This means that foam plastics are approximately one twenty-fifth as heavy as cork, one one-hundredth as heavy as water, and one seven-hundredth as heavy as steel. As a result, they have exceptional bouyancy. Foam plastics do not rot in water and are not subject to corrosion. (See Khimiya bol'shikh molekul (Large Molecule Chemistry), Collection of Articles, Publishing House of Academy of Sciences USSR [Moscow], 1958, page 10)

Everyone is aware of the great importance of polymeric materials as synthetic rubber in the economy. A new type of so-called polyurethane rubber is produced from products of the coal-tar and oil refining industry. Automobile tires made from it, with capron cords, easily withstand travel over 100,000-120,000 kilometers without losing their tread pattern.

The production of a different type of artificial fibers and imitation leather and fur goods is of no less significance. Their variety is very great. It is possible to produce anything from capron, nylon, elastin, lavsan and other polymeric materials, from a simple, very strong thread to artificial furs. Thus, in many cases synthetic materials prove to be stronger, cheaper, and more durable than natural ones, mainly because it is possible to give all of them those qualities and characteristics needed in any given case. It is not always possible to achieve this in the production of materials from natural silk, flax, cotton, leather, wool, etc.

Not the least among the polymeric materials are the various synthetic glues and resins. The remarkable ability of synthetic glue to unite not only similar, but also dissimilar, materials opens wide prospects for its use in industry and construction. Many of the synthetic resins can be used instead of cement, tar, and other viscous materials used in road and airport construction. For example, furfurol resin, which is obtained from peat, corncobs, sawdust, and sunflower hulls, is capable of bonding soil particles, thus forming a sufficiently strong covering for airports and roads.

Ion-exchange resins -- the ionites -- have a special quality. They retain on their surface the most diverse chemical elements and are insoluble in water. With the aid of ionites, more concentrated solutions are obtained from solutions of weak concentration, and vice versa. The Scientific Research Institute of Plastics has produced and tested ionite membranes which make it possible to obtain drinking water from strong salt water. The British Navy already uses these resins as distillers of sea water.

The principal qualities of polymeric materials -- low specific weight, high resistance to corrosion, water resistance, heat resistance, durability, and cheapness -- make them materials which will make it possible to solve many problems in the development of military equipment.

The Soviet Union has unlimited raw material resources for the production of polymeric materials. They are petroleum and natural gases, phosphorites, sulfur, potassium salts, shales, products of petroleum refining and of the coke chemistry and wood industry, agricultural production wastes, etc.

The state and potential of polymer chemistry are now such that obtaining new materials with properties heretofore unseen is not an insoluble problem. The use in industry of polymeric materials which have been subjected to atomic radiation makes it possible to obtain, from already known polymeric materials, new ones with more valuable qualities. For example, if polyethylene is subjected to radiation, the result obtained is a hard, waterproof plastic with new, improved qualities. Radioactive radiation of high-molecular compounds may produce many types of such synthetic materials, whose qualities and properties would now seem unusual.

Considering the qualities of polymeric materials mentioned above, it is opportune to raise the question of their wider utilization in all branches of military equipment and armament.

The supersonic speeds at which modern aircraft fly result in heating of the metal surfaces to high temperatures and loss of strength.

Glass plastics treated with organic silicon compounds which do not lose their properties at a temperature of 550 degrees centigrade open up the possibility of using polymeric materials for solving the problem of overcoming the heat barrier. Moreover, the construction of airplanes and jet engine housings from heat-resistant plastic glass reduces the totalweight of the plane by 25-35 percent. The possibility arises of increasing the relative power of the engines and the speed of fligt. It is anticipated that the cost of a glass plastic plane will be lower than a metal one, which is highly important in mass production.

Special plastics, experience has shown, allow radar impulses to pass through themsleves without changing their direction. As a result, the press has published suppositions concerning the possible appearance in the near future of airplanes and rockets produced from plastics, which will be difficult or almost impossible to observe with modern radar facilities. (See Krasnaya Zvezda, 22 August 1958)

The wide use of plastics in military-transport and helicopter aviation will make it possible to considerably improve tactical-technical characteristics of aircraft through reduced design weight and increased useful load capacity, relative engine power, and flight speed. At the same time, the cost of each plane is reduced. Airplane construction technology will become different. Molding and gluing with synthetic glues will replace riveting, soldering, and welding of airplane parts and engines. New, still more modern methods of gluing and new glues will ensure great strength in uniting plane sections and parts. The change in technology will reduce airplane production time.

The above statements apply equally to rocket construction. The body of the rocket and other parts produced from glass plastic are stronger, considerably lighter, more heat-resistant, and cheaper than rockets produced from metal alloys.

Plastics are to find the widest application in airfield engineering with respect to combat and military transport aviation bases. Honeycomb plastics of enhanced strength may be used with success in the production of synthetic surface units for take-off and landing strips, airplane parking areas, and taxiways.

The weight of the assembly set for portable metal take-off and landing strips (MVPP) with perforated plates is approximately 4,500-5,000 tons. In honeycomb plastic, the weight of the same portable take-off and landing strip set would amount, according to calculations, to only 800-1,000 tons, with a cover of the same strength. Transport of a metal take-off and landing strip requires seven or eight railroad trains or up to 1,000 hauls by 5-ton truck, while a plastic take-off and landing strip requires only one to 1 1/2 railroad trains or up to 200 hauls by 5-ton truck. Thus, the savings in transport, fuel and lubricants, and time are very appreciable.

The US Air Force has already developed two types of synthetic surfaces for take-off and landing strips. One of these, the so-called "sandwich" type, is produced from canvas panels impregnated with plastics and from glass plastics, and glued in layers under pressure. The second, an assembled type, is simply honeycomb plastic panels measuring 360 by 90 by 2.5 centimeters. Experience shows that honeycomb plastic panels may be used successfully on weak soils.

The comparatively low cost, waterproof quality and high anticorrosive properties of honeycomb plastic panels, and the possibility of producing them on a considerably larger scale than metal ones, raise the possibility that honeycomb plastic panels may be used not only as units of portable take-off and landing strips, but also as elements in permanent airfield installations.

Polymeric materials will find wide application in all arms of the Ground Troops. They are certain to have considerable influence on the development of armored equipment.

Replacement of steel in heavy and expensive armor with synthetic plastic armor has many advantages. Such armor has already been developed. In 1957 in West Germany, tests were conducted on a tank with plastic armor equal in strength to steel, but weighing only a fraction as much. (Krasnaya Zvezda, 30 July 1958)

According to preliminary estimates, the weight of a medium tank with plastic armor may be 20-22 tons, while the armor will have the same qualities as the steel type but the tank will gain great mobility and roadability.

The above statements apply equally to armored carriers and self-propelled artillery units, which with plastic armor will be only two fifths to one half as heavy as steel. The weight reduction will make it possible to increase the ammunition and fuel supply, to install heavier weapons on armored carriers and self-propelled units, and to improve their combat characteristics. It is easier to give a more streamlined, atomic-resistant shape to a tank, armored carrier, or self-propelled artillery unit with plastic armor. The use of plastic will make it possible to improve the hermetic sealing, heat insulation, and soundproofing of the hull.

With the use of plastics in armored vehicle construction, the technology of production will change as in aviation. Bonding with synthetic glues will replace electric and gas welding. Instead of casting of the hull, turret, and other parts of tanks, self-propelled artillery pieces, and armored carriers, moldings of laminated glass plastics will be widely employed. This will considerably simplify the technology and increase labor productivity in armored vehicle production.

Operation, repair, and maintenance of armored equipment will be simplified and cheapened. One painting of this equipment will save hundreds of millions of rubles, since plastic does not require additional painting.

The use of plastics in small arms will undoubtedly have an advantageous result. Submachine guns, carbines, rifles, pistols, and hand machine guns with plastic stocks will be lighter, more durable, cheaper, and more practical than weapons with wooden stocks. Trench mortars and recoilless weapons made from the best grades of plastic will prove to be one third to one half as heavy as steel ones, and this will increase their tactical mobility. Their cost will be a fraction of the cost of steel ones.

Replacement of nonferrous metals in the production of ammunition will prove no less important. Rifle cartridges and artillery shells with plastic cases will be cheaper and simpler to produce and will last longer in storage. The casings of high-explosive, chemical, smoke and special shells, aerial bombs, and mines may also be plastic. This makes it possible, by reducing the weight of the shell, to reduce the weight of the powder charge and, though the given increase of volume, to increase the weight of explosive or other shell content. It is also advantageous to make rocket-launching artillery projectiles of plastic, making only the fragmentation part of shell out of metal.

This will obviously necessitate a review of many principles of ballistics and a change of weight ratios between systems, shells, and charges. However, this is fully justified if the colossal expense of artillery and aviation ammunition in modern war is taken into consideration.

Artillery observation and control devices are already being produced from plastic. But many still have a metal base. Plastics will probably supplant metal in this field in the near future. Artillerymen must receive light, cheap, and portable artillery observation and fire-control instruments instead of cumbersome, heavy, and expensive ones.

It is well known how important it would be for engineer units to have at their disposal armored engineer equipment permitting support of combat activity of troops in immediate contact with the enemy. The use of plastics opens up a real possibility for developing armored engineer equipment and, within the same weight specifications, without reducing the productivity and maneuverability of engineer machines. Finally, there appears the possibility of developing multiroller mine-clearing drags and sweeping devices with vibrating working elements.

Mechanization of the process of neutralizing enemy mine barriers has been complicated by the cumbersomeness and heavy weight of mine-sweeping devices.

Replacing of metal casings of antitank, antilanding, river, antipersonnel, and special mines with plastic is advantageous because it will be impossible to detect them with existing induction mine detectors. Plastic mine casings are more durable, can be used many times under any conditions, do not react chemically with the explosive charge, do not rust, and require considerably less expense per container in transport and in painting, lubrication, and maintenance in warehouse storage.

The use of foam plastics in landing and stream-crossing equipment and bridge trains is of great interest. Plastic cases and foam plastic fillers for landing and stream-crossing conveyances and pontons increase considerably their tactical and technical characteristics; increase their load capacity, speed in water, waterproof quality, and durability; and considerably reduce the cost of their production, maintenance, and repair.

Plastic and foam plastic stream-crossing units are practically unsinkable. Thousands of bullet and fragmentation hits will not put them out of commission.

Preservation of flotation suits, pneumatic boats, and rescue equipment from such materials as nylon, lavsan, and others is much simpler and more economical than from rubberized materials and expensive cork. Moreover, they are stronger and lighter.

The question of possibilities for the use of different plastics in automobile construction should also be mentioned. A military vehicle (and any series-produced automobile in the economy may become one), in addition to all the positive qualities of strength, must have high roadability, fireproof qualities, and sufficient stability under atomic explosions. It is almost impossible to obtain all these necessary qualities in the modern automobile of wood and metal. Polymeric materials have come to the aid of automobile industry designers and engineers. It is possible and necessary to develop from plastics a light, fast-moving, and fireproof vehicle. The first steps have already been made in this field. A ZIL-112 racing automobile with a body made of polyester plastic glass was demonstrated at the All-Union Agricultural Exhibition in 1958. This automobile had high roadability and was able to develop a speed of up to 240 kilometers per hour.

Thermal radiation from an atomic explosion and napalm are less dangerous for a plastic body with a fiber-glass top than for a wooden body with a cotton top. In addition, decontamination of the latter is extremely difficult. The use of polyurethane rubber and capron cord, as mentioned above, makes automobile tires two to three times as durable.

Synthetic materials will render an invaluable service in the development of new camouflage equipment. The various types of camouflage covers and mock-ups produced on a cotton, linen, hemp, or paper base are weak and highly inflammable. Camouflage covers of various fiber glasses which are processed with special synthetic resins are nonflammable, which is extremely important in defense against napalm and thermal radiation from an atomic explosion. They do not rot and are more durable.

It is necessary to train engineers and road troops in all possible uses of plastics and synthetics in road construction.

Honeycomb and reinforced plastics can be produced for road surfaces, replacing wood, reinforced-concrete, and wire mesh sections. A plastic grid section with the same dimensions and strength as wood, reinforced-concrete, and wire mesh panels weighs no more than 30-70 kilograms. One kilometer of plastic track road will weigh approximately 40-50 tons and its transport will require 15-20 hauls by 3-ton truck, while a kilometer of track road of reinforced-concrete sections weighs about 700 tons and its transport requires 220-250 hauls by 3-ton truck.

A no less important innovation in road construction is the use of synthetics, particularly furfurol-aniline resins, as binding materials. It is necessary to examine the experience acquired on this problem and conduct wide experimentation in troop units on new synthetic materials in the stabilization of soils.

Wide employment of glass plastics and glass textolites in bridge construction must be secured. These matierials will make it possible to fully solve the problem of authorized portable bridging. It is important also to point out the advantage of using plastic materials for storage and transport of water. Containers for storage and transport of water produced from polymeric materials are much superior to containers of rubberized fabric. A nylon container, for example, is stronger and cheaper than a rubber container and lacks its unpleasant odor.

Various plastics are already being used to a considerable extent in the production of modern communications equipment. Insulation for wires and cables of polyethelene and other polymeric materials is steadily coming into use and is even replacing successfully such ideal insulators as lead. The housings and cases for telephone and telegraph apparatus, radio stations, metering instruments, sockets of radio tubes, panels for various communication apparatus, and many other items are produced from plastic. Plastic insulation increases also the conductivity, electric shielding, strength, durability, and waterproof quality of wires and cables, not to mention the fact that the cost of the production of such insulation is much lower than the cost using natural materials.

Parts with a high degree of insulation and fine tolerances are extremely important in radio, radar, and electronic equipment. And here plastic is now the best material. Plastic casings for batteries are clearly superior to others because of their acid- and alkali-resistant qualities.

Reports have appeared in the press that plastic telegraph poles, which are lighter and more resistant to wear than wooden ones, are being used in certain foreign countries for permanent communication lines. This is not a priority matter for us at present; however, it seems quite opportune and necessary to develop and introduce plastic masts for radio relay stations.

Production of "printed circuits" from plastics ensures their high quality. Many plastics are good insulators, but with the addition of silver or copper dust they become excellent conductors.

Various types of polystyrene are used very effectively as insulators in high-frequency cables, condensers, wave carriers, and many parts of radio stations, radar sets, and ultrashort-wave and electronic equipment.

The use of plastics in electric, radio, and electronic equipment improves the quality of the equipment and reduces its weight, dimensions, and cost. Moreover, all possibilities of plastic have not yet been exhausted in these fields. The development of communications, electronics, and electrical equipment is closely dependent on the wide introduction of the best types of synthetic materials in their production.

The rear services may become the main consumer of various plastics and synthetic fibers. All articles of troop clothing, beginning with shoes, uniforms, and personal equipment and ending with winter and fur clothing for the army and fleet, may be produced from synthetic fibers -- capron, nylon, nitron, lavsan, and others. These materials have high mechanical strength and are waterproof and sufficiently fireproof, qualities which make them irreplaceable under the conditions of service in the field and in combat. Uniforms and shoes of synthetic materials are waterproof, soft, durable, and easily cleaned and disinfected; they lose practically none of their original form and color, and have a permanently neat appearance.

Underwear made from synthetic fibers is distinguished by great strength, ease of laundering, retention of its original color, and freedom from parasites. Polyvinyl chloride underwear, in addition, has remarkable therapeutic qualities which are very effective in different types of rheumatic diseases and radiculitis.

Uniforms and fur articles made of synthetic materials are now used with considerably greater convenience in armies. For example, a fur-lined three-quarter-length coat of artificial goat skin or astrakhan fur will weigh only 1-1.5 kilograms, compared with 4-6 kilograms for one of natural fur. Rain-soaked overcoats and fur-lined three-quarter-length coats of natural materials weigh 5-6 and up to 10 kilograms, respectively, whereas those of synthetic materials retain a constant weight.

Synthetic materials make it possible, finally, to develop a so-called "antiatomic suit," which weakens to a certain extent the action of thermal and nuclear radiation on combatants in the area of an atomic explosion.

Helmets of the same and even greater strength than metal may be produced out of plastics, in particular out of capron, nylon, and nitron. Plastic helmets will be one third to one half the weight of steel ones. It is possible to produce soft, light, bulletproof clothing of any style from capron and nitron.

Wood, metal, glass, and cardboard containers, dishes, vacuum containers, and supply cases, which are necessary in huge quantities for troops and rear installations, have remained until now impractical, expensive, easily destroyed, and heavy. Polymeric materials open up wide possibilities for production of cheap, strong, light, unbreakable, indestructible, moistureproof, and heat-resistant containers, dishes, and supply cases, whose period of service may be ten times longer than that of existing types.

A new type of waterproof film with exceptional strength and lightness, which is being produced by the chemical industry, will be very important in the rear services. It may successfully replace heavy and expensive tarpaulin. It is possible to produce from synthetic film flexible boxes, coverings, tents for troops, and even large tents for headquarters, hospitals, warehouses, repair bases, garages, and shelters for planes, rockets, and other special equipment.

Inflatable warehouses of a two-layer film with a volume of up to 6,000 cubic meters are being publicized in the US and England. It is considered possible to erect such a warehouse in one hour. (See Khimiya bol'shikh molekul, page 60.)

Proposals for using plastics for the production of rigid and flexible containers for the transport and storage of fuel under any conditions, even under water, deserve attention. Nylon casings and tankers with a volume of several thousand tons, which are towed on water, are employed for this purpose. Cylindrical casings with a volume of several tons, in outer appearance similar to wide automobile tires, are used on dry land for storage of fuels and lubricants.

A plastic briquette with a honeycomb structure in which it is convenient to pack solid gasoline is of special interest. The specific gravity of the briquette with gasoline is 0.7-0.75. Plastic occupies 5 percent of the volume of the briquette, and gasoline 95 percent. It is possible to pack kerosene, solar oil and other types of fuels and lubricants in the plastic briquette.

As the experience of the Institute of Combustible Minerals of the Academy of Sciences USSR has shown, it is possible to store briquettes of solidified petroleum products for years in the earth, on its surface, in water, and under other conditions. They do not change their properties in temperatures from plus 50 degrees to minus 60 degrees centigrade. Our polar explorers in the North and Antarctica are using them successfully. Solidified gasoline is economical. For example, 20-30 grams of solidified gasoline are required to boil a liter of water. It is transported in any type of transport and over varying distances, without containers. The use of plastics in this opens up wide possibilities, if only because it will be possible to reduce automobile tanker transport to a certain extent.

Plastic pipelines for transport of fuel and lubricants will be considerably more advantageous than metal ones. It is sufficient to note that 270 four-ton trucks are required for the transport of a set of metal pipe, and no more than 60 such trucks for a similar plastic set.

For rear service organizations, the wide introduction of plastics means first of all reduction of transport and, hence, of the requirement for transport vehicles, and a saving of hundreds of tons of fuel.

Polymeric materials also make it possible to develop many hidden possibilities in military medicine. It is possible to obtain a substitute for blood by a synthetic method. (See Nauka i Zhizn', No 3, 1958, page 4.) It is possible to produce a plastic from high-molecular compounds which is used with success in burns. This is extremely important under the conditions of mass burn injuries to personnel in atomic explosions.

Experience shows that some types of plastics are entirely suitable for production of all kinds of prosthetic appliances, the properties of which surpass existing types. With plastics, inserts in blood vessels are made and sections of skin, bone, and even whole joints are replaced. Threads of polymeric materials are used for surgical stitching. Such threads are absorbed without any aftereffects. (See Meditsinskiy Rabotnik, 20 June 1958.)

Utilization of ion-exchange resins in medical practice is no less promising. Ionites, introduced in the blood, removed from it part of the calcium salts and, at the same time, render the blood less coagulate. This is extremely important in blood transfusions during operations and in the treatment of the heart and circulatory system. Some types of ionites have the ability to remove acids from the content of the stomach and intestines. As a result, ionites may be used successfully in the treatment of ulcers, gastritis, and other stomach diseases.

A great number of medicines has been obtained by the synthetic method, and bandaging materials of synthetic fibers are beginning to be widely introduced in medical practice. X-ray and other medical equipment produced from plastic will become lighter and more portable. This will improve the technical equipment of field medical units. Replacement of glass instruments, appliances, dishes, and packaging for medicines with plastic products and containers will result in great benefits and considerable economy.

The Moscow Plant imeni Kalinin has produced a boat weighing 28 kilograms. It is easily transported by one man, is not subject to corrosion, and does not rot. When in water it does not absorb moisture; therefore,

its weight is constant. It is produced from glass plastic. This type of plastic is three times stronger than wood; and wood weighs twice as much, steel five to six times as much, and aluminum 2 1/2 times as much. For the same weight, glass plastic products are not inferior in strength to the best grades of steel.

The same glass plastic plant is constructing a diesel-powered boat 15 meters long. It is estimated that it will weigh no more than 2 tons. Its cargo capacity is 40 percent more than a metal diesel-powered craft of the same size. The cost of a plastic diesel-powered boat in series production will be 30-50 percent lower than the cost of a similar diesel-powered ship built from metal, and the labor consumption in its production will be 10-15 percent less.

Glass plastics with properties not inferior to those of the best grades of steel -- this is only the first step in obtaining strong materials. There is no doubt that there will appear in the future polymeric materials from which it will be possible to construct not only rescue boats, but even large surface ships and submarines.

The use of plastics in the navy is advantageous for many reasons. In the first place, sea water does not corrode a ship's hull having a plastic surface. In the second place, the cargo capacity of a plastic ship is 30-40 percent greater than that of a metal ship because of the lower specific gravity of materials. Because of its perfectly smooth surface the ship acquires better seagoing qualities and, with a power plant of the same capacity as in a ship with a metal hull, may gain an increase in speed of 10-20 percent. If the hull of the ship or submarine is coated with a film of fluorine plastic, which has an insignificant coefficient of friction (0.064), then it will be possible to increase the speed even more. In the third place, plastic ships would be considerably simpler in design and the time required for their construction would be one third to one half less; hence, their cost will be lower than that of metal ships. The plastic surface of the ship does not collect barnacles.

Secure joining of any metals with plastics already makes it possible to build surface ships and submarines of a design which might provide a reasonable combination of a metal hull and a plastic skin. Subsequently, with the obtaining of stronger plastics, there will appear the possibility of building a ship's hull completely out of plastic.

Equipment of the ship and also interior appointments of crew and other quarters with plastics will improve them and lower the cost. The use of plastics reduces the inflammability of individual parts of the ship and of the ship as a whole, eliminates the magnetized condition of the hull, and therefore removes the danger of damage to the ship from electromagnetic mines.

The use of transparent plastics will improve illumination and observation of underwater conditions from inside submarines and the holds of surface ships.

Foam plastics, which are waterproof, have an extremely low specific gravity, are comparatively strong, and may be used in the construction of waterproof bulkheads. Foam plastic bulkheads, at the same time, provide excellent heat and sound insulation.

Many types of ship armaments -- rockets, antiaircraft rocket shells, torpedoes, and antisubmarine mines -- would have more advantages with plastic than with metal casings.

Gun turrets and shields of ship artillery and antiaircraft machine guns could also be produced from plastic. The newspaper Krasnaya Zvezda reported on 30 July 1958 that the Canadian Navy had tested a twin-mounted antiaircraft gun with polyester plastic armor reinforced with glass fiber. The armor proved to be many times stronger than steel armor of the same weight.

In the present article we have attempted to examine in general terms the important problem, in our opinion, of using in the Air and Ground Forces and the Navy new polymeric materials with remarkable qualities, without, of course, touching upon specific problems. Perhaps it would be interesting to mention the fact that topographic maps, sea charts, and important operations documents could and should be produced from a special type of nylon paper which resists moisture, acid chemicals, light, bacteria, and high temperatures, and may be stored for a practically unlimited time. It is almost impossible to tear nylon paper with the hands.

A real possibility is provided at present for using various plastics and synthetics for planning and design work and in the development of experimental models of military equipment. Military engineers, designers, and technicians have the serious assignment of developing, testing, and preparing for series production in a short time experimental models of military equipment using polymeric materials, with the expectation that industry may begin mass production in the near future.

The use of polymeric materials in the Armed Forces of the Soviet Union will save the state millions of rubles, millions of tons of steel, and hundreds of thousands of tons of nonferrous metals, and will reduce labor consumption in defense industry. -- Lt Gen Engr Trps N. SLYUNIN

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